

Electrical Resistance Tomography for Subsurface Imaging

Dramatically increased resolution at lower cost

Current methods of subsurface imaging in underground cleanup operations allow only limited one-dimensional resolution. High-resolution imaging is needed to better define site characteristics, monitor remediation activities, and delineate natural processes that control contaminant migration. Electrical resistance tomography (ERT), a new method that produces two- and three-dimensional subsurface images, provides dramatically increased resolution and sensitivity. It also saves on drilling costs and site damage because fewer boreholes are required than in standard borehole logging.

Measures electrical resistance

ERT images are generated from measurements of electrical resistance. Electrical resistivity changes underground are caused by natural or human processes such as surface water infiltration, underground tank leaks, and steam or human-produced heating during soil cleanup.

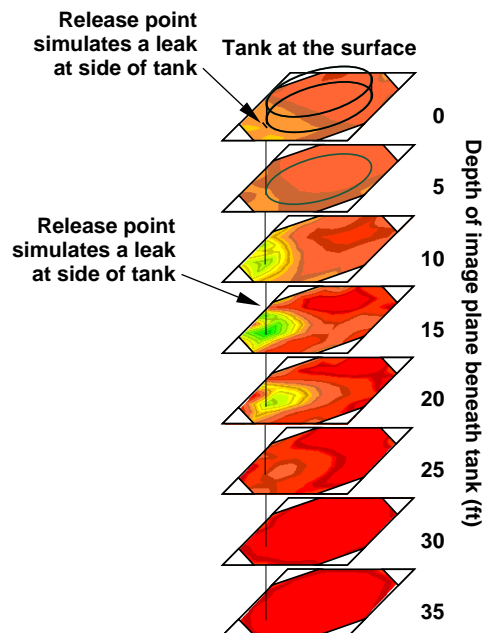
Besides site characterization in soil remediation projects, applications of the technique include detection and location of subsurface leaks, evaluation of the effectiveness of cleanup techniques, cleanup process control, and

nondestructive evaluation of large structures such as pavements, buildings, and dams.

Recent work

We are investigating the utility of ERT for detecting leaks from metal underground storage tanks. Several technical challenges need to be solved. The high electrical conductivity of the metal tends to short the electrical currents used to probe the subsurface, possibly reducing or eliminating the sensitivity of ERT to these releases.

In the first of two brine-release experiments conducted at Hanford, Washington, in 1994, we used low-concentration



ERT images made during a brine release from an underground storage tank. The image planes, when assembled together, give a detailed view of the plume formed beneath the tank during the release.

test brine that was much harder to detect than real tank brines; ERT successfully detected and located the leak and the spilled volume of brine.

Availability: We are actively seeking to transfer the technology to commercial partners who can provide the ERT surveys needed at many government and industrial sites.

Contacts

Abe Ramirez
 Phone: (510) 422-6909
 Fax: (510) 422-3118
 E-mail: ramirez3@llnl.gov
 Mail code: L-206

Bill Daily
 Phone: (510) 422-8623
 E-mail: daily1@llnl.gov
 Mail code: L-156

ADVANTAGES

- Unprecedented subsurface detail (at depths of ≥ 10 –500 feet)
- Two- and three-dimensional imaging
- 50–75% fewer boreholes than conventional techniques
- Updated survey images in 1–6 hours
- Electrodes are rugged, inexpensive, and easily emplaced
- Effective in both clay-rich and sandy soils